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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/805,966

03/22/2004

Vikram Singh

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2603

7590

01/25/2007

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EXAMINER

ALEJANDRO MULERO, LUZ L

ART UNIT

PAPER NUMBER

1763

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

01/25/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/805,966	<b>Applicant(s)</b> SINGH ET AL.	
	<b>Examiner</b> Luz L. Alejandro	<b>Art Unit</b> 1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 30 October 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-25 and 27-32 is/are pending in the application.
- 4a) Of the above claim(s) 6,22 and 23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-5,7-21,24,25 and 27-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 10 is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification, as originally filed, does not enable one of ordinary skill in the art how to make an apparatus in which a parasitic antenna is coupled to the plasma chamber via a thermally conductive elastomer.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-3, 7-8, and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Kadomura, U.S. Patent 5,567,268.

Kadomura shows the invention as claimed including a plasma apparatus comprising: a plasma chamber configured to receive a process gas; a radio frequency

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source 39 configured to resonate radio frequency currents in a radio frequency antenna; a radio frequency antenna including an active antenna (22 or 31) surrounding the plasma chamber and coupled to the RF source and a parasitic antenna (31 or 22) surrounding the plasma chamber and not directly coupled to any RF source; and a platen 29 for holding a target, wherein electromagnetic fields induced by the radio frequency currents are effective to pass into the plasma chamber and excite and ionize the process gas to generate plasma within the plasma chamber (see figs. 2-3 and their description).

Concerning claims 2-3, note that the active antenna can be considered either the vertically or the horizontally extending coil (22 or 31) depending upon which coil has the RF power applied. Furthermore, note that the parasitic antenna (31 or 22) can be considered either the vertically or the horizontally extending coil depending upon which coil is left open.

Regarding claim 7, note that the inner diameter of each antenna is greater than a size of the target.

With respect to claim 8, note that the parasitic antenna can be considered to be above and coaxial with the active antenna.

Concerning claim 11, the plasma chamber includes: a horizontal planar section 24 positioned above the platen 29; a vertical cylindrical section extending from the horizontal planar section; and a top section 21 coupled to the vertically cylindrical section.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Sahin et al., U.S. Patent 6,465,051.

Kadomura is applied as above but does not expressly disclose where the parasitic antenna has one of its ends grounded. Sahin et al. discloses grounding an antenna 26 during processing, for example, in order to perform a cleaning process (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to allow for grounding of either of the antennas to allow for more

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flexibility when using the apparatus, for example, to allow for efficient cleaning of the apparatus.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Sahin et al., U.S. Patent 6,465,051, as applied to claim 4 above, and further in view of Okumura et al., U.S. Patent 5,888,413.

Kadomura and Sahin et al. are applied as above but do not expressly disclose means for adjusting a number of turns of the parasitic antenna providing a parasitic effect. Okumura et al. discloses means for adjusting the length and the number of turns of a coil (see figs. 20-23 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Sahin et al. so as to allow the coils to have their lengths and turns adjusted as suggested by Okumura et al. because in such a way the plasma density can be effectively controlled and adjusted.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Ishimaru, U.S. Patent 5,681,418.

Kadomura is applied as above but does not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify the apparatus of Kadomura so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claims 12-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but does not expressly disclose wherein the vertical cylindrical section is made of a high quality dielectric, and the top conductive section is made of aluminum and grounded. Collins et al. discloses wherein a vertical cylindrical section 17W is made of a dielectric, and the top conductive section 17T is made of aluminum and grounded (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to comprise the vertically cylinder and top conductive section of Collins et al. because this will allow the improvement of process uniformity.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 as applied to claims 12-13 and 15 above, and further in view of Fitzsimmons et al., U.S. Patent 6,626,188.

Kadomura and Collins et al. are applied as above but do not expressly disclose wherein the ceramic material is one from a list including aluminum nitride. Fitzsimmons et al. discloses having aluminum nitride walls exposed to the plasma within the chamber

(see fig. 3 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. so as to form aluminum nitride in the plasma chamber because in such a way beneficial results will be produced such as the reduction of contamination.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 as applied to claims 12-13 and 15 above, and further in view of Trow et al., U.S. Patent 5,824,607.

Kadomura and Collins et al. are applied as above but do not expressly disclose where the top conductive section is liquid cooled. Trow et al. discloses where a top conductive section is cooled by liquid (see col. 4-lines 40-50). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. so as to cool by liquid because liquid is shown to be an adequate means of cooling a top conductive member of a plasma apparatus.

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Kumagai, U.S. Patent 5,916,455.

Kadomura is applied as above but does not expressly disclose a plasma igniter for introducing a strike gas into the plasma chamber to assist in igniting a plasma.



Kumagai discloses a plasma igniter 30 for introducing a strike gas into the plasma chamber to assist in igniting a plasma (see fig. 1-2 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to comprise a plasma igniter because in such a way plasma will be more easily ignited for processing within the apparatus.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins, U.S. Patent 5,707,486.

Kadomura is applied as above but does not expressly disclose a gas source controller for maintaining a pressure of a plasma chamber at a predetermined value. Collins discloses a controller for controlling the pressure of a plasma chamber (see col. 13-lines 6-20). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to include the controller of Collins to control the pressure of the plasma chamber because such a device would allow for greater controllability over the process performed within the apparatus.

Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501.

Kadomura is applied as above but does not expressly disclose the RF source operating at a low frequency. Collins et al. discloses a RF source 31 which has a

frequency in a range from 100kHz to 100 Mhz (see col. 11-lines 25-40). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to provide the RF source of Collins et al. because this will allow for the selection of a top source which minimizes damage to sensitive devices and also provides efficient inductive coupling.

Claims 24-25, 27 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607.

Kadomura shows the invention substantially as claimed including a plasma chamber comprising: a horizontal planar section for positioning above a platen; a vertical cylindrical dielectric section 21 extending from the horizontal planar section; and a radio frequency antenna including a horizontally-extending coil 22 positioned proximate to the horizontal planar dielectric section and a vertically-extending coil 31 positioned proximate to the vertical cylindrical dielectric section, the radio frequency antenna including radio frequency currents into the plasma chamber that excite and ionize a process gas so as to generate a plasma in the plasma chamber (see fig. 2 and its description).

Kadomura does not expressly disclose a liquid cooled top conductive section coupled to the vertical section. Collins et al. discloses a plasma chamber comprising a cooled top conductive section 17T coupled to a vertical dielectric section 17W (see fig. 1 and its description). Furthermore, Trow et al. discloses where a top conductive section

is cooled by liquid (see col. 4-lines 40-50). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura so as to include a liquid cooled top conductive section as disclosed by Collins et al. and Trow et al. because in such a way the coupling of the plasma with the wafer will be improved while at the same time having improved controllability of the temperature of the chamber walls.

Concerning claim 25, note that in the apparatus of Kadomura modified by Collins et al. and Trow et al., the top conductive section is grounded (see Collins et al. at col. 21-lines 60-67).

With respect to claim 31, note that in the apparatus of Kadomura modified by Collins et al. and Trow et al. the horizontally extended coil 22 is capable of being coupled to an RF source.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Sahin et al., U.S. Patent 6,465,051.

Kadomura, Collins et al., and Trow are applied as above but does not expressly disclose where the parasitic antenna has one of its ends grounded. Sahin et al. discloses grounding an antenna 26 during processing, for example, in order to perform a cleaning process (see fig. 1 and its description). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made

to modify the apparatus of Kadomura modified by Collins et al. and Trow so as to allow for grounding of either of the antennas to allow for more flexibility when using the apparatus, for example, to allow for efficient cleaning of the apparatus.

Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501, Trow et al., U.S. Patent 5,824,607, and Sahin et al., U.S. Patent 6,465,051, as applied to claim 28 above, and further in view of Okumura et al., U.S. Patent 5,888,413.

Kadomura, Collins et al. Trow, and Sahin et al. are applied as above but do not expressly disclose means for adjusting a number of turns of the parasitic antenna providing a parasitic effect. Okumura et al. discloses means for adjusting the length and the number of turns of a coil (see figs. 20-23 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. Trow, and Sahin et al. so as to allow the coils to have their lengths and turns adjusted as suggested by Okumura et al. because in such a way the plasma density can be effectively controlled and adjusted.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Ishimaru, U.S. Patent 5,681,418.

Kadomura, Collins et al., and Trow et al. are applied as above but do not expressly disclose wherein at least one antenna is liquid cooled. Ishimaru discloses forming a coil 40 which flows liquid water coolant therethrough (see col. 5-lines 13-21). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. and Trow et al. so as to liquid cool the antenna because in such a way overheating of the antenna can be prevented.

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kadomura, U.S. Patent 5,567,268 in view of Collins et al., U.S. Patent 5,556,501 and Trow et al., U.S. Patent 5,824,607 as applied to claims 24-25, 27, and 31 above, and further in view of Kumagai, U.S. Patent 5,916,455.

Kadomura, Collins et al. and Trow et al. are applied as above but do not expressly disclose a strike gas inlet. Kumagai discloses a strike gas inlet (see ignition chamber 30) whereby plasma is ignited and expelled into the inductively coupled plasma chamber (see fig. 1-2 and their descriptions). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Kadomura modified by Collins et al. and Trow et al. so as to comprise a strike gas inlet because in such a way plasma will be more easily ignited for processing within the apparatus.

***Response to Arguments***

Applicant's arguments filed 10/30/06 with respect to claims 1-5 and 7-21 have been fully considered but they are not persuasive.

Applicant argues that the antenna mentioned in Kadomura as being the parasitic antenna will not be the parasitic antenna because it does not perform the same function as the parasitic antenna of the instant invention. However, the examiner respectfully submits that the word "parasitic" has not been defined by the specification of the instant invention. Furthermore, the examiner believes that the parasitic antenna of Kadomura will perform the same function as in the instant application, and no secondary evidence has been provided by the applicant to show otherwise.

Regarding the fact that the apparatus of Kadomura does not show plasma immersion ion implantation, the claims are directed to method limitations instead of apparatus limitations. Since an apparatus is being claimed as the instant invention, the method teachings are not considered to be the matter at hand, since a variety of methods can be done with the apparatus. The method limitations are viewed as intended uses which do not further limit, and therefore do not patentably distinguish the claimed invention. The apparatus of Kadomura is capable of performing the claimed processes on the claimed substrate under atmospheric pressure and achieving the claimed results.

Applicant's arguments with respect to claims 24-25 and 27-32 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

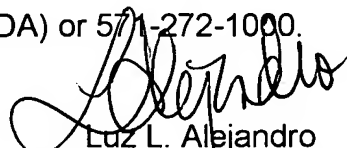
Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 571-272-1430. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

  
Luz L. Alejandro  
Primary Examiner  
Art Unit 1763

January 22, 2007